

SCOPE OF WORK FORM FOR EXPERIMENT AND NON-EXPERIMENTAL WORK

Project No:		Name:	Zikri Yusof
Project title:	Photocathode Deposition System	Location (Building/Room, etc.):	366
Project start date:	June 2004	Project end date:	None
Date of submission:	June 26, 2008	Submission type:	Renewal

The Project Manager / Principle Investigator must be familiar with the responsibilities and the requirements of the experiment safety review in the *ESH Manual*, Section 21.2.

Work may not be performed until procedures have been approved, and authorization is granted. This completed form, and all supporting documentation must be submitted to the division ES&H Coordinator. Appropriate personnel for ES&H issues associated with the proposed work will review the information. The Project Manager must resolve outstanding issues before the work begins; no work may begin until Approval and Authorization is granted.


Project Manager Approval

6/26/2008
Date


Review Approval

Date
7/9/2008


ES&H Authorization

Date

Division Authorization

Date

SCOPE OF WORK (ISM STEP 1)

General Description

Provide a general overview description of the experiment (or non-experimental work project). Describe specific equipment relating to tasks within the project, concentrate on operations that focus on the work, and summarize the hazards that you expect to encounter. Attach designs,

drawings, or other useful descriptive material.

A cathode deposition system designed to produced Cs₂Te photocathodes has been in operation. The system uses thermal vapor deposition to evaporate the photocathode onto a molybdenum substrate.

The system consists of:

- (i) vacuum chamber expected to operate in the 10^{-10} Torr range
- (ii) vacuum pumps consisting of a roughing pump, a turbo pump, and an ion pump, with corresponding pressure gauges and controllers
- (iii) a 350 W Hg arc lamp
- (iv) dual thermal evaporation systems
- (v) a thickness monitor
- (vi) an picoameter/anode system
- (vii) a future load-lock cathode transfer system
- (viii) Te nuggets and a fixed Cs getter source.

Possible safety issues are:

(i) UV light from Hg arc lamp. The output from the light source is be very low (less than 1 mW) after all the optics. Further safety steps are taken to build proper shielding from the light output end to the entrance window into the vacuum chamber (engineering control). UV safety glasses are required during operations and the laboratory will have restricted access (administrative control).

(ii) Cs and Te sources. The Cs source is in a stable, chromate metal salts encased in a dispenser. It is manufactured by SAES Getters. It can be exposed to air. Cs atoms will only be liberated upon passing a current between 4.5A to 7.5A through the dispenser. Te source is in the form of nuggets that are rather benign in air. MSDS for both materials are posted in the laboratory. The spent Cs dispenser are collected and will be disposed of in a manner approved by industrial hygiene.

(iii) Current sources for evaporation system. These are sources that, under normal operating conditions, will supply up to 8 A of current. These will have shields that cover the exposed terminals (engineering control).

HAZARD ANALYSIS (ISM STEP 2)

Hazard List

Examples include but are not limited to the examples below. You may expand your comments on hazard analysis in the scope of work (ISM STEP 1) section of this document.

Low Risk

- ☐ Delivery of items such as furniture, office supplies.
- ☐ Equipment (bench top set up) utilizing hand tools and that does not fall into another hazard classification
- ☐ Equipment repair, de-energized, utilizing hand tools, and that does not fall into another hazard classification
- ☐ Equipment calibration, de-energized, utilizing hand tools, and that does not fall into another hazard classification
- ☐ Computer set-up
- ☐ Installation of window blinds that requires no power tools or use of a ladder
- ☐ Performing office-type tasks
- ☐ Assembly of technical components with use of hand tools and no exposure to additional hazards of a greater risk

Moderate Risk

- ☐ Installation of furniture utilizing power tools, battery operated tools or hand tools
- ☐ Installation of office partitions including repair and modification to existing partitions, shelving involving no hard wiring of electrical connections, plug type only
- ☐ Installations of carpet with or without utilizing consumer quantity of adhesive product
- ☐ Low voltage calibration/testing below 50 volts
- ☐ Repair and/or window glass replacement, window cleaning below 6 ft.
- ☐ Repairs that do not require lockout/tagout or use of chemicals that are above a consumer commodity quantity
- ☐ Kitchen appliance repair with out any additional exposure to a high risk activity
- ☐ Activity that does not involve working with any type of energy source, working above 6 ft., or entry into a confined space
- ☐ Painting with latex paint
- ☐ Site survey work that is not within 6. of a roadway and does not include the use of lasers higher than class 2
- ☐ Tree and flower planting in pots or planters
- ☐ Use of class 2 lasers
- ☐ Assembly of technical components utilizing power tools, battery operated tools, or hand tools
- ☐ Assembly of purchased component utilizing power tools, battery operated tools, or hand tools
- ☐ Service of experimental mechanical devices utilizing power tools, battery operated tools, or hand tools
- ☐ Installation of wire cages utilizing power tools, battery operated tools, or hand tools

High Risk

- ☐ Electrical or other energy sources requiring lockout/tagout for any installation or modification
- ☐ Working with or having an exposure to hazardous materials (e.g., toxins, carcinogens, asbestos, lead, beryllium, etc.)
- ☐ Excavations of any type or depth that requires a Dig Permit
- ☐ Confined spaces
- ☐ Noise levels above 85 dB
- ☐ Ionizing radiation (per entry posting)
- ☐ Non-ionizing radiation (per entry posting)
- ☐ Working on energized equipment of greater than 50 volts
- ☐ Installation of office partitions containing electrical hard wire electrical connections
- ☐ Activity requiring lockout/tagout of energy source
- ☐ Work on transformer

- ☐ Working with the potential for a fall from a height greater than 6 ft
- ☐ Pole work of any nature
- ☐ Communication tower work including erecting, painting, or inspection
- ☐ Elevator repair/maintenance/inspection
- ☐ Overhead crane inspections or repair
- ☐ Equipment alignment of energized equipment
- ☐ Sprinkler repairs or modifications
- ☐ Utility line work on gas line, electrical, water, steam, air, or communication
- ☐ Mechanical work that may include welding, cutting, burning, or any open flame work, metal grinding, or saw cutting
- ☐ Concrete boring/cutting/grinding/jack hammering
- ☐ Hoisting, rigging, or lifting
- ☐ Parking lot paving and striping
- ☐ Tree and stump removal, grass burning, or chemical treatments
- ☐ Laser repair and installation
- ☐ Painting with epoxy paint
- ☐ Chiller or refrigerant repair/recovery or replacement
- ☐ Chemical use (use of flammable products, asbestos abatement, work on lead painted surfaces)
- ☐ Potential releases to environmental media (air, land, surface water, and/or groundwater)
- ☐ Equipment use (cranes, fork lift, scissor lift, boom lift, scaffolds, back hoes, bobcats)
- ☐ Other high risk situations as determined by line management or the division ES&H coordinator

Yes No

☐ **Is this job performed in a location or environment having a special designation where specific precautions are to be observed?**

Examples (Check those applicable)

- ☐ Nuclear facility
- ☐ Nonnuclear radiological facility
- ☐ Radiological controlled area
- ☐ Outdoor-NEPA review
- ☐ Indoor-laboratory, service area, common area
- ☐ Floor loading limitations
- ☐ Noise posted area
- ☐ Laser controlled area
- ☐ Biohazard area
- ☐ Magnetic field
- ☐ Ultraviolet (UV)
- ☐ Microwave
- ☐ High heat/cryogenics
- ☐ Hazardous/flammable/reactive chemicals
- ☐ Energized systems, electrical, pressure
- ☐ Confined space
- ☐ Elevated 6 feet or more above working level
- ☐ Asbestos, lead, mercury, beryllium in area or could be disturbed
- ☐ Clean room

☐ Other specifically defined locations or environments?

Yes No

☐ ☐ Is this job a complex activity?

Examples (Check those applicable)

- ☐ More than one work group necessary to complete the job.
- ☐ Steps of a task or tasks of a job must be completed in an exact sequence.
- ☐ Shutdowns of various systems and lockout/tagouts of various energy sources must be completed.
- ☐ Life safety features/egress routes altered.
- ☐ Additional specific training/skills/knowledge/fitness required for those performing task.
- ☐ Materials handling issues - heavy, bulky, hazardous materials handled individually, with manually operated equipment with powered equipment such as forklifts, cranes, etc.
- ☐ Other specific complex activities? You may expand your comments in the scope of work (ISM STEP 1) section of this document.

HAZARD CONTROLS (ISM STEP 3)

ENGINEERING CONTROLS

Describe the engineering controls applied to control the hazards. Engineering controls include enclosures and barriers that cannot be removed without the use of tools, interlocks, ventilation, software controls, etc.

Task	Engineering controls
UV light source	Shielding built between source and vacuum chamber input window Approved eye protection required.
Exposed electrode terminals	Shielding installed when in operation.

Laboratory access	Laboratory access is via keypad.
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ADMINISTRATIVE CONTROLS

List all work procedures, permits and checklists necessary to mitigate hazards. The Project Manager must describe where skill of the researcher/craft/work is being relied upon for hazard mitigation and control.

Task	Administrative controls
Cathode deposition	PI has prior experience and skill in thermal and sputtering va deposition techniques. The SOP is posted in the laboratory. On approved personnel are permitted to perform work, which curren consists only of the PI.
Project permission	The whole project and system have been evaluated by a safety r committee and formal approval for operation has been obtained.

PERSONAL PROTECTIVE EQUIPMENT

Specify personal protective equipment (PPE) to be worn. For gloves, be specific as to the type appropriate for the task and which steps in the activity the PPE is required.

Task	PPE
Eye protection	Approved safety glasses to be worn.

WORKING WITHIN CONTROLS (ISM STEP 4)

All work must be performed within the controls for all the identified hazards.

It is the Project Manager responsibility to verify that this document is kept up to date and determine if changes are significant enough to require a new review/document.

FEEDBACK (ISM STEP 5)

Identify types of records or reporting method that is useful for improvement on the tasks relating to this project. This could include lab notebooks, datasheets, computer data, instrument logs, images, etc.

Task/Situation	Record
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emergency	Call 911, take appropriate immediate action (e.g., evacuate sp. notify supervisor, building manager, division management, ESH coordinator)
Work record	All work are recorded in the laboratory notebook.

Yes No

☒ ☐ Was a graded approach applied to this scope of work? Graded approach for example is to have a knowledgeable colleague that will not supervise nor perform the experiment or non-experimental work, examine the setup then document his or her conclusions in accordance with the ANLHEP_644 form for divisional work approval and authorization.

If yes, describe the graded approach taken.

A safety review committee was formed to evaluate the cathode deposition system after it was first assembled. Upon evaluation, several issues were brought up to improve the safety of the system. These were adopted and implemented. A second review was performed to ensure that all the issues have been addressed. Upon the second review, a formal approval to perform the project was obtained.